

# Ch. 10 and 11

Ideal Gas - a gas that behaves accordingly to the Kinetic Molecular Theory (KMT)

↳ KMT

1. All samples of the gas consists of large numbers of tiny particles.
2. Particles are in a constant state of motion
3. Particles undergo elastic collisions (no energy lost)
- \* 4. No attractive forces between gas particles
5. Kinetic Energy is directly proportionate to temperature.  
↳  $KE \uparrow \rightarrow Temp. \uparrow$

Basic Gas Properties:

- Diffusion - Spreading of a gas in the absence of air currents

- Expansion/Compression

- Low Density -  $\frac{m}{V}$

- Fluidity - Particles can easily glide past each other (Pourable)

Behaviors of Gases

↳ 4 variables of gases:

- Pressure (P) - Collisions that gas particles make with walls.

$$P = \frac{\text{Force}}{\text{Area}}$$

- Temperature (T) - Average Kinetic Energy (How fast particles move)

- Volume (V) - Space gas particles occupy

- Moles (n) - Number of particles

Qualitative Behaviors of Gases

P vs. T @ Constant n + V

As T goes up, P goes up because as particles move faster, they collide more so P goes up.

P vs. V @ Constant T + n

If V goes up, P goes down because in a larger space the number of collisions decrease so P goes down.

11/10/11

The first part of the paper is a review of the literature on the topic of the paper.

The second part of the paper is a description of the methodology used in the study.

The third part of the paper is a presentation of the results of the study.

The fourth part of the paper is a discussion of the implications of the results.

The fifth part of the paper is a conclusion.

The sixth part of the paper is a list of references.

The seventh part of the paper is an appendix.

The eighth part of the paper is a list of figures.

The ninth part of the paper is a list of tables.

The tenth part of the paper is a list of abbreviations.

The eleventh part of the paper is a list of symbols.

The twelfth part of the paper is a list of acronyms.

The thirteenth part of the paper is a list of keywords.

The fourteenth part of the paper is a list of subject headings.



### V vs. T @ Constant P + n

As T goes up, V goes up because as particles move faster, they spread out and occupy a larger V

### P vs. n @ Constant V + T

As n goes up, P goes up because more particles will have more collisions, so more P

### V vs. n @ Constant T + P

If n goes up, V goes up because more particles occupy more space.

### Measuring Pressure

In 1643 Torricelli measured atmospheric pressure with a Hg (mercury) Barometer.

Barometer: Measures how far the atmospheric pressure pushes the Hg up the tube.

Standard P = 760 mmHg = 760 torr = 1.0 atm (atmosphere)  
101.3 kPa (kilo Pascals)

- 800 torr = ? atm

$$800 \text{ torr} \times \frac{1 \text{ atm}}{760 \text{ torr}} = 1.04 \text{ atm}$$

- 0.95 atm = ? kPa

$$0.95 \text{ atm} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}} = 96.2 \text{ kPa}$$

- 152 kPa = ? mmHg

$$152 \text{ kPa} \times \frac{760 \text{ mmHg}}{101.3 \text{ kPa}} = 1140 \text{ mmHg}$$

### Boyle's Law

If V doubles, P decreases by half (vice versa)

- Inverse Proportion between V + P

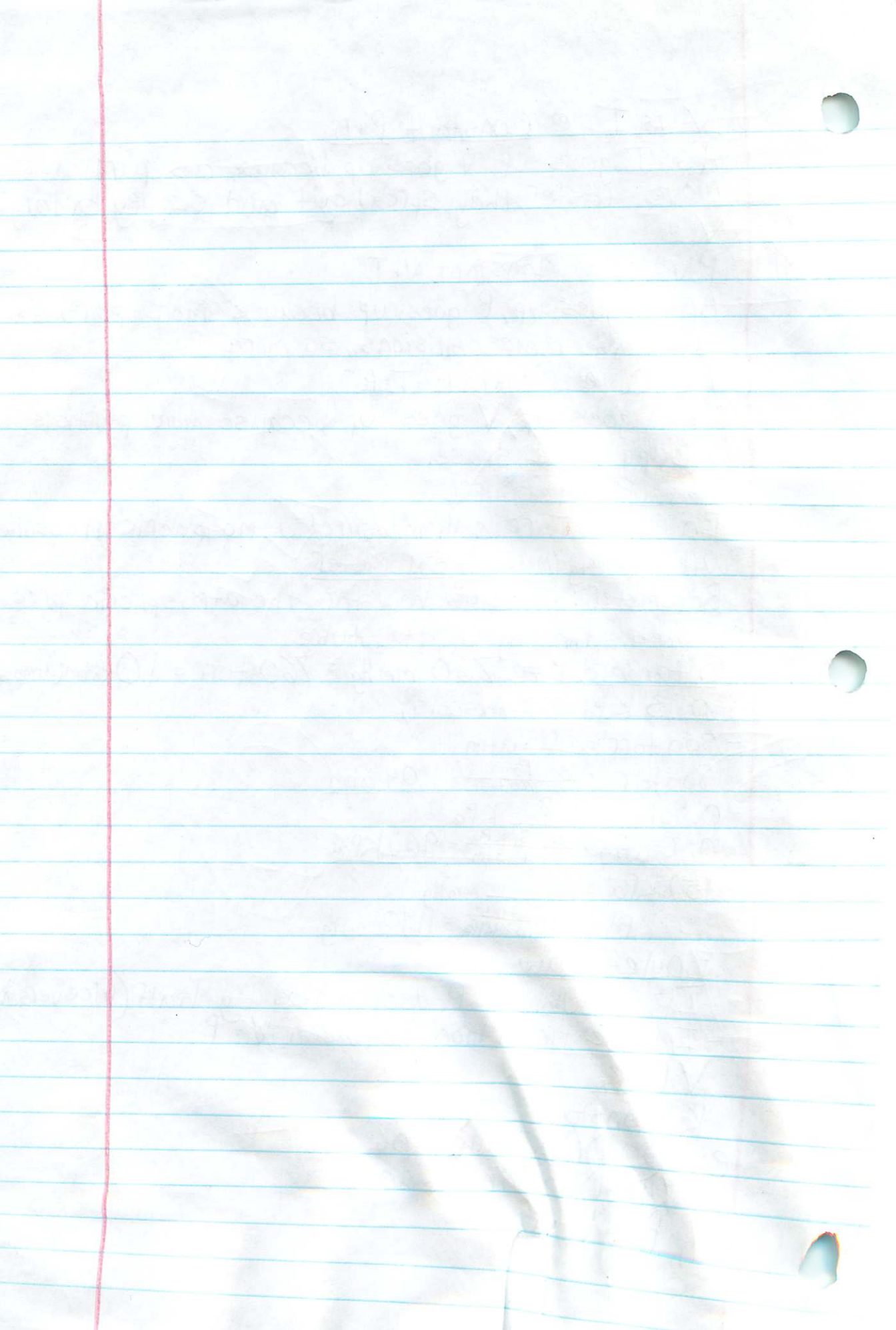
$$V \cdot P = k$$

K = constant

ex:  $(20 \text{ mL})(30.3 \text{ inHg}) = 606$

$(40 \text{ mL})(15.15 \text{ inHg}) = 606$

$$V_1 \cdot P_1 = V_2 \cdot P_2$$





## Charles' Law 1787

V vs. T

$V \uparrow \rightarrow T \uparrow$  (Direct proportion)

- If  $T \uparrow$  by 1,  $V \uparrow$  by  $\frac{1}{273}$

Inverse -  $XY = k$

Direct -  $y = k \cdot x$

ex:  $\frac{V_1}{T_1} = k(P+n)$

$$\frac{V_2}{T_2} = k$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Charles' Law

$$V_1 T_2 = V_2 T_1$$

T must be in Kelvin

$$K = ^\circ C + 273$$

## Gay-Lussac's Law

$$P_1 T_2 = P_2 T_1$$

## Combined Gas Law

$$V_1 P_1 T_2 = V_2 P_2 T_1$$

T = Kelvin

STP

standard

temp.

and  
pressure

